FORM PTO-1390 (REV 5-93) | U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE | ATTORNEY'S DOCKET NUMBER: 1662/49745

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U S APPLICATION NO (if known, see 37 CFR 1 5): 09/786274

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP99/06401	1 September 1999	2 September 1998

TITLE OF INVENTION
Pressure Control Device for Vehicle

APPLICANT(S) FOR DO/EO/US
HILBERER Eduard

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371
3. [ ] This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. [ ] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [ ] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [X] has been transmitted by the International Bureau
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US)
6. [ ] A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [X] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [X] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (Unexecuted)
10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Item 11. to 16. below concern other document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [ ] A FIRST preliminary amendment.
    [ ] A SECOND or SUBSEQUENT preliminary amendment.
14. [ ] A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [X] Other items or information:
PCT Form 308

U.S. APPLICATION NO (if known, see 37 CFR 1 5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
09/786274	PCT/EP99/06401	1662/49745

17. [ ] The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)):		
Search Report has been prepared by the EPO or JPO ..... $860.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... $690.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482)	$860.00	
but international search fee paid to USPTO (37 CFR 1.445(a)(2) ..... $710.00 Neither international preliminary examination fee (37 CFR 1.482) nor	$0.00	
international search fee (37CFR 1.445(a)(2) paid to USPTO ..... $1000.00 International preliminary examination fee paid to USPTO (37 CFR 1.482)		
and all claims satisfied provisions of PCT Article 33(2)-(4) $100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$860.00	
Surcharge of $130.00 for furnishing the oath or declaration later than [ ]20 [ ]30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

Claims	Number Filed	Number Extra	Rate		
Total Claims	-20=	0	X $18.00	$0.00	
Independent Claims	-3=	0	X $80.00	$0.00	
Multiple dependent claims(s) (if applicable)			+ $270.00	$	
TOTAL OF ABOVE CALCULATIONS =				$	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).				$	
SUBTOTAL =				$	
Processing fee of $130.00 for furnishing the English translation later than [ ]20 [ ]30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28,3.31). $40.00 per property +				$0.00	
TOTAL FEE ENCLOSED =				$860.00	
				Amount to be: refunded	$
				charged	$

a. [X] One check in the amount of $ 860.00 for the filing fee is enclosed
b. [ ] Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.
c. [X] The Commissioner is hereby authorized to charge any additional fees, which may be required, or credit any overpayment to Deposit Account No. 05-1323. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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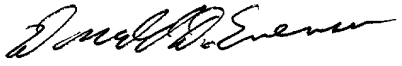

SIGNATURE
Donald Evenson
NAME
29, 004
REGISTRATION NUMBER
March 2, 2001
DATE

Attorney Docket: 1662/49745
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: EDUARD HILBERER

Serial No.: 09/786,274 PCT NO.: PCT/EP99/06401

Filed: MARCH 2, 2001

Title: PRESSURE CONTROL DEVICE FOR VEHICLES

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Please enter the following amendments to the specification, claims and abstract prior to the examination of the application.

IN THE SPECIFICATION:

A substitute specification and a marked-up copy thereof is submitted herewith.

IN THE CLAIMS:

Please cancel claims 1-23 presently in the application and substitute new claims 24-53 as follows:

--24. A pressure control device for a vehicle, comprising:

a control device;

at least one of a mechanical, pneumatic and hydraulic element coupled with the control device, wherein recesses or

holes are provided in at least one of the control device and the element;

at least one sensor which is accommodatable at least partially in one of said recesses or holes; and

a bending resistant element operatively coupled to absorb pressure forces acting on the at least one sensor.

25. The pressure control device according to claim 24, wherein the control device comprises a printed circuit board provided with said recesses or holes for the at least one sensor.

26. The pressure control device according to claim 24, wherein the control device includes first and second casing parts, said first and second casing parts being mutually connectible such that the first and second casing parts form a substantially closed chamber of the control device.

27. The pressure control device according to claim 25, wherein the control device includes first and second casing parts, said first and second casing parts being mutually connectible such that the first and second casing parts form a substantially closed chamber of the control device.

28. The pressure control device according to claim 26, wherein said at least one of the mechanical, pneumatic and hydraulic element forms the second casing part.

29. The pressure control device according to claim 27, wherein said at least one of the mechanical, pneumatic and hydraulic element forms the second casing part.

30. The pressure control device according to claim 24, wherein said element is a hydraulic valve block.

31. The pressure control device according to claim 28, wherein said element is a hydraulic valve block.

32. The pressure control device according to claim 26, wherein the second casing part is a control valve block for a vehicle compressed-air system.

33. The pressure control device according to claim 24, wherein the bending-resistant element is a casing part of the control device.

34. The pressure control device according to claim 26, wherein the bending-resistant element is one of the first and second casing parts.

35. The pressure control device according to claim 28, wherein the bending-resistant element is one of the first and second casing parts.

36. The pressure control device according to claim 24, wherein the bending-resistant element is connectible with a casing part of the control device.

37. The pressure control device according to claim 26, wherein the bending-resistant element is connectible with a casing part of the control device.

38. The pressure control device according to claim 28, wherein the bending-resistant element is connectible with a casing part of the control device.

39. The pressure control device according to claim 24, wherein the at least one sensor is controlled and has its signals processed in the control device.

40. The pressure control device according to claim 24, further comprising an amplifier provided in the control device, said amplifier amplifying signals of the at least one sensor.

41. The pressure control device according to claim 40, wherein a plurality of amplifiers are provided in the control device, said amplifiers being respectively arranged in direct or indirect vicinity of a plurality of sensors respectively assigned thereto.

42. The pressure control device according to claim 24, wherein an electrical connection between the at least one sensor and the control device is made at least partially via a flexible line.

43. The pressure control device according to claim 24, further comprising a storage element arranged in the pressure control device.

44. The pressure control device according to claim 43, wherein calibration values of the at least one sensor and/or regulating or control parameters of the control device are storable in the storage element.

45. The pressure control device according to claim 26, wherein the at least one sensor is arranged in an area between the first and second casing parts.

46. The pressure control device according to claim 45, wherein said first and second casing parts hold the at least one sensor arranged in an area therebetween.

47. The pressure control device according to claim 24, further comprising at least one seal provided to seal-off the at least one sensor arranged in the recess or hole.

48. The pressure control device according to claim 26, further comprising at least one seal provided to seal-off the at least one sensor arranged in the recess or hole.

49. The pressure control device according to claim 48, wherein the seal is provided between a pressure connection of the second casing part and the at least one sensor.

50. The pressure control device according to claim 24, wherein the at least one sensor has a pot-shaped construction.

51. The pressure control device according to claim 50, wherein the at least one sensor is held by a casing part via an edge of the pot-shaped construction.

52. The pressure control device according to claim 50, wherein a sensor membrane is arranged on a pot bottom of the pot-shaped construction.

53. The pressure control device according to claim 51, wherein a sensor membrane is arranged on a pot bottom of the pot-shaped construction.--

IN THE ABSTRACT:

Please add an Abstract of the Disclosure submitted herewith on a separate page.

REMARKS

Entry of the amendments to the specification, claims and abstract before examination of the application is respectfully requested.

If there are any questions regarding this Preliminary Amendment or this application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

It is respectfully requested that, if necessary to effect a timely response, this paper be considered as a Petition for an Extension of Time sufficient to effect a timely response and shortages in other fees, be charged, or any overpayment in fees be credited, to the Account of Crowell & Moring, L.L.P., Deposit Account No. 05-1323 (Docket #1662/49745).

Respectfully submitted,

August 3, 2001

Jeffrey D. Sanok
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--**ABSTRACT OF THE DISCLOSURE**

The invention relates to a pressure control device for vehicles comprising a control device, a mechanical, pneumatic and/or hydraulic element and at least one sensor and/or at least one actuator. The invention is characterized in that, in the area of the sensors and/or actuators, recesses or cavities are provided in the control device and/or in the element. The sensors and/or actuators can at least be partially accommodated in said recesses or cavities.--

#3

Attorney Docket: 1662/49745
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: EDUARD HILBERER

Serial No.: 09/786,274 PCT NO.: PCT/EP99/06401

Filed: MARCH 2, 2001

Title: PRESSURE CONTROL DEVICE FOR VEHICLES

SUBMISSION OF SUBSTITUTE SPECIFICATION

Commissioner for Patents
Washington, D.C. 20231

Sir:

Attached is a Substitute Specification and a marked-up copy of the original specification. I certify that said substitute specification contains no new matter and includes the changes indicated in the marked-up copy of the original specification.

Respectfully submitted,

August 3, 2001

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Clean Copy of Substitute Specification

PRESSURE CONTROL DEVICE FOR VEHICLES

BACKGROUND AND SUMMARY OF THE INVENTION

[0001] The invention relates to a pressure control device for vehicles comprising a control device, a mechanical, pneumatic and/or hydraulic element and at least one sensor and/or an actuator.

[0002] Such pressure control devices are provided for use in pressure medium systems of, among others, vehicles. These may be constructed as pneumatic or hydraulic systems, in which case brake systems, level control systems, etc. are supplied by means of these systems.

[0003] German patent document DE-A-44 45 125 discloses a housing for an electric component, which housing consists of a housing bottom part and a housing top part. These parts can be connected with one another. In addition, a support is known from this document which supports the electric component situated in the housing and has corresponding electric connecting devices for the sealed connection of the electric component situated in the housing with an electric component situated outside the housing. Although such an arrangement has advantages in a modular construction, it is very time-consuming to assemble it with additional components, such as

sensors and actuators. Also, additional, relatively long cables for connecting the sensors and actuators with the control device as well as additional housings for the sensors and actuators are required for protection against environmental influences. In addition, high-expenditure wirings and measures have to be carried out in order to protect the known control device against line-borne interferences of the additional cables.

[0004] It is therefore an object of the present invention to provide a pressure control unit with a control device, a mechanical, pneumatic and/or hydraulic element and at least one sensor and/or an actuator. The connection of the control device with the sensors, actuators and additional elements requires only a small amount of material, permits fast assembly and therefore saves time and cost.

[0005] This object is achieved in that a known pressure control device is further developed so that, in the area of the sensors and/or actuators, recesses or holes are provided in the control device and/or the mechanical, pneumatic and/or hydraulic element, in which the sensors and/or actuators can be at least partially accommodated.

[0006] The reason is that, as a result of this measure according to the invention, the mechanical, pneumatic and/or

hydraulic element is moved into the direct proximity of the control device, so that the cable lengths can be kept short. Because of the measure that the mechanical, pneumatic and/or hydraulic element comprises a pressure control device, the assembly time is also reduced because now only one component or the pressure control device has to be mounted on the vehicle essentially by itself and not, as previously, at least two components with an additional mounting of other cables. As a result, material costs are also saved because only few casing parts are required for protecting the respective components from environmental influences.

[0007] When, preferably, at least one sensor and/or an actuator is arranged in the casing, it is possible to calibrate and test the control device with the sensors and/or actuators as a simple structural component. When, preferably in the area of the sensors and/or actuators, recesses or holes are provided in the mechanical and/or pneumatic and/or hydraulic element and/or in the control device, the sensors and/or actuators can be moved into the direct proximity of the components of the control device, so that long cable lengths can be avoided. The holes or recesses are preferably constructed on mutually facing sides of the element and of the control device.

[0008] The control device used according to the invention is an electric and/or mechanical control device. The control device preferably comprises a printed circuit board which is provided with recesses or holes for the sensors and/or actuators. In this manner, an even more compact construction can be obtained which can be mounted more rapidly.

[0009] Also preferably, the pressure control device comprises a casing having a first and a second casing part, the casing parts being mutually connectible. The first casing part together with the second casing part for at least the control device forms an essentially closed chamber. This measure permits a simple mounting and, in addition, a simple protection against environmental influences for the control device and additional components, such as in particular electric components.

[0010] The connectibility of the first and second casing part is preferably detachable in a firm manner. According to the field of application, seals are provided which protect the casing interior against water, dirt or the like. Furthermore, connections of a mechanical or electrical nature are preferably provided which have the effect that the interior area of the casing can be connected with the exterior area.

[0011] The mechanical, pneumatic and/or hydraulic element is preferably the second casing part. Further material can be saved as a result of this measure.

[0012] The hydraulic element is preferably a valve block. In this manner, it is possible to use a valve block with the pertaining control device as a single structural component.

[0013] The second casing part is preferably a control valve block for the compressed-air system of a vehicle.

[0014] When a bending-resistant element is preferably provided, forces, which otherwise act upon the casing, can be compensated without damage to the casing or the control device.

[0015] The bending-resistant element is preferably a casing part. In addition, the bending-resistant element can preferably be connected with a casing part.

[0016] If the bending-resistant element is provided for absorbing the pressure forces of the sensors and/or actuators, the control device will be mechanically protected. If, for example, preferably the control device comprises a printed circuit board, as a result of the absorption of forces by the bending-resistant element, there will be no hairline cracks on

the printed circuit board because the latter will not be bent as a result of the application of force to the bending-resistant element.

[0017] Preferably, the controlling and the signal processing of the sensors and/or actuators takes place in the control device.

[0018] At least one amplifier is preferably provided in the control device, which amplifier amplifies the signals of the sensors. An active and/or passive cooling of the amplifiers (or of corresponding power semiconductors) is preferably provided. This cooling preferably takes place by way of cooling sheets and a portion of the exterior part of the casing.

[0019] If the amplifiers are arranged preferably in the direct or indirect vicinity of the sensors, which can be assigned, the connections to the amplifiers can be kept short so that few outside interferences can enter these cables. If the electric connection between the sensor and the control device takes place at least partially by way of flexible lines or one flexible line, the sensors and actuators can be moved with respect to the control device while the connection to the control device would suffer no fatigue and would not be destroyed.

[0020] A storage element is preferably constructed in the pressure control device. Also preferably, the calibrating values of the sensors and/or actuators and/or regulating parameters or control parameters of the control device can be stored in the storage element. This measure has the advantage that no external storage elements are required so that additional longer cables are also avoided.

[0021] The sensors and/or actuators are preferably arranged in an area between the two casing parts. Also preferably, the sensors and/or actuators are held by the two casing parts. As a result of these measures, additional holding elements can preferably be saved and a mounting is correspondingly simplified.

[0022] If, preferably, at least one seal is provided which seals off the sensors and/or actuators, a discharge of pressure medium from the pressure medium outlet bore, for example, of a valve block, will be avoided. Depending on the embodiment of the present invention, different seals can be used which achieve the sealing in different fashions. The seal is preferably provided between the pressure connection of the second casing part and the sensor. As a result of this measure, only a single seal will be required. In addition, as a result of this measure, by means of the correspondingly firm or loose mounting of a component pressing onto the sensor,

such as the first casing part or the bending-resistant element, the contact pressure onto the seal can be adapted according to the requirements or pressure conditions, the used material, the environmental influences and the like.

[0023] The sensor is preferably cup-shaped. Also preferably, the sensor is held or guided by way of the edge of the cup-bottom by a casing part. As a result of this measure, the cup-shaped sensors can be fitted well. In the event of corresponding pressure variations, these will not cause corresponding pressure medium leakages at this connection from the pressure medium to the control device.

[0024] When the sensor membrane is preferably constructed on the cup bottom, this membrane is protected from corresponding damage by a not quite appropriate mounting.

[0025] The invention will be described in the following as an example without any limitation of the general idea of the invention by means of embodiments with reference to the drawings, to which reference is also made with respect to the disclosure of all details according to the invention which are not explained in detail in the text.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] Figure 1 is a schematic representation of an embodiment of a casing according to the invention;

[0027] Figure 2 is a schematic representation of another embodiment of a casing according to the invention;

[0028] Figure 3 is a schematic and enlarged representation illustrating the fitting of a sensor onto a valve block; and

[0029] Figure 4 is a schematic representation of another fitting of a sensor onto a valve block.

DETAILED DESCRIPTION OF THE DRAWINGS

[0030] In the following figures, respective identical or corresponding parts have the same reference number so that they will not be introduced again and only deviations of the embodiments illustrated in these figures from the first embodiment will be discussed.

[0031] Figure 1 is a schematic representation of a first embodiment of the pressure control device according to the invention. Within the scope of this invention, the term pressure control device also comprises a pressure regulating device. Figure 1 specifically shows a control device cover 5 which is connected with a housing bottom part 4 by way of

screws 6. The pressure control device comprises the housing formed by the housing bottom part 4 and the control device cover 5. The control device 20 is arranged in this housing. The housing bottom part 4 is a valve block. The valve block has a pressure medium feeding connection 1, a pressure medium return flow connection 2 and outlet connections 3. The outlet connections 3 are respectively connected with pressure medium outlet bores 17. Furthermore, a mechanical control and regulating unit 11 is provided in the valve block and is connected with solenoid valves 12. In addition, recesses are provided in the valve block into which the control device screw heads 21 and pressure sensors 8 can be fitted. The mechanical control and regulating unit is also connected with a bore which leads to a return valve 24 which is connected with a relief bore 25 of the pressure sensors 8.

[0032] The control device 20 is fastened by means of control device screws 21 on the control device cover 5.

[0033] The components of the control device 20 are arranged on a printed circuit board 21. Holes are provided in the printed circuit board 27 for accommodating the control device screws 27, the sensors 8 and the solenoids 12 in each case at least partially. Above the bores for the sensors, recesses are provided in the control device cover 5, which recesses represent a relief space 26. The holes in the printed circuit

board can also be called printed circuit board openings 9 which have a diameter D for the sensors. The signals from and to the sensors 8 are transmitted by way of flexible lines 10 to the printed circuit board or to components of the control device, which, in particular, are arranged on the printed circuit board. The components are, for example, microcontrollers 14, instrument amplifiers 15, electrically writable and readable or overwritable memories (such as EE or Flash ROM) 16 or power semiconductors 19.

[0034] In addition, solenoid valve vents 7 are provided in the control device cover 5. Sealing elements 13 are provided for sealing off, for example, the compressed air. For communicating with the exterior area, particularly for transmitting electric or electronic signals from and to the control device, connectors 22 are provided which have a connector line 23.

[0035] In order to protect the control device from environmental influences, such as dirt, water and the like, sealing elements are provided, such as a control device cover seal and a connector seal 28.

[0036] Figure 1 shows an embodiment as a multichannel pressure control valve. The implemented example of the invention consists of a valve block 4, which has a pressure

medium feeding connection 1, a pressure medium outlet connection 3 and a central pressure medium return flow connection 2 which, in the case of a pneumatic valve, is equal to a vent. The mechanical control and regulating unit 11 takes over the signal amplification functions and determines the backup regulating behavior of the valve in the event of a power failure.

[0037] The relief bore 25 of the relative pressure sensors 8 used in this example is connected with the return valve 24. As a result, it is possible to reduce pressure rises caused by temperature fluctuations in the relief space 26 to the central pressure medium return flow. In this manner, the pressure buildup in the relief space 26 due to sealing leakages can also be reduced. The return valve 24 prevents the penetration of pressure surges from the pressure medium return flow 2 into the relief space 26.

[0038] The electric connections, thus particularly the voltage supply and the output signal of the pressure sensors 8, are fed by means of a flexible line 10 to the electric or electronic control device 20. The output signal of the pressure sensors is amplified by the instrument amplifier 15, before it is processed by the processor.

[0039] When the operation of the control device is first started, two defined pressures are applied to the pressure sensors, and the measured pertaining output signal values, which were processed by the control device, are stored in an electrically writable and erasable or electrically overwritable memory. It is therefore possible to use low-cost, not adjusted relative pressure sensors and to calibrate these.

[0040] The heat of the power semiconductors is transmitted by way of an applied heat-conducting material 33 into the control device cover in order to prevent overheating.

[0041] The solenoid valves 12 are also mounted on the control device, and their electric connections are also guided to the control device by means of a flexible line.

[0042] By means of the electric line 23, the connector 22 is connected with the control device 20. By means of the sealing element 28, the connector 22 is sealed off with respect to the housing cover 5. The housing cover 5 is sealed off by means of the seal 18 with respect to the valve block 4. The housing cover 5 is screwed by means of the cover screws 6 onto the valve block. The valve block 4 represents the casing bottom part. As a result of this method of construction, a very compact design of a casing can be obtained which is easy

to mount and in which a control device as well as a mechanical, pneumatic and/or hydraulic element, such as a valve block or a cylinder block, are integrated. In addition, flexible lines 39 are provided.

[0043] In Figure 1, the housing cover 5 is constructed to be so bending-resistant that it absorbs and transmits forces affecting it while it is not significantly deformed or even damaged. The pressure forces acting upon the pressure sensors are therefore returned into the valve block. The reason is that the pressure sensors are held down by the housing cover 5.

[0044] The embodiment according to the invention illustrated in Figure 2 shows an additional compressed-air storage device and a measuring connection for external pressures. External pressures can be measured by way of the measuring connection 29. This is required in the case of load sensing valve functioning methods. In addition, as illustrated above, an additional pressure medium storage device 30 exists so that the valve can rapidly react to high pressure demands in that pressure media are taken from this storage device. Another advantage of this construction is the possibility of absorbing external control pressures by the control connection 31.

[0045] Particularly in the case of narrow space conditions or narrow installation conditions, it is advantageous for the connector 22 to be arranged in the housing bottom part.

[0046] In addition, a bending-resistant component 34 is provided, which is not identical with the housing cover 5. As a result of this measure, particularly in the case of a large cover, the cover can be constructed at reasonable cost of a plastic material while the respective effective forces could not damage the cover. The bending-resistant component 34 can be constructed to be locally limited and small and can be connected particularly with the housing bottom part, thus, in this example, with the valve block. In this embodiment, the housing cover is screwed onto the housing bottom part by means of additional cover screws 32.

[0047] In addition, another connector 35 is shown which permits the receiving and processing or transmitting of external signals. The electric signals are fed to the control device by way of the signal line 36.

[0048] Thus, particularly also a control casing construction was introduced in which the following characteristics were in each case met individually, or partially or completely combined with one another. The casing bottom part is a valve block. The valve block has a pressure

medium feeding connection and at least one pressure medium outlet connection. The pressure in the pressure medium outlet bore is measured by a pressure sensor. A microcontroller compares the pressure in the pressure medium outlet bore with stored pressure values and correspondingly readjusts by means of an electrically controlled actuator. A mechanical control and regulating unit exists which determines the pressure, control and emergency operating characteristics in the event of a power failure. A pressure medium return flow connection is provided which, in the case of a pneumatic application corresponds to a venting. In addition, an electric control device is provided which has at least a power semiconductor 19, a microcontroller 14 and a writable data memory 16. In the area of the sensors, the printed circuit board of the electric control device is provided with an opening through which the sensors are guided and/or kept down. The pressure forces acting upon the sensors are compensated by a bending-resistant component which is connected with the valve block. The sensor signal is amplified by amplifiers situated on the printed circuit board. The electric supply of the sensor and the electric output signal of the sensor are transmitted to the printed circuit board by means of a flexible line. The calibrating values of the sensors and the regulating parameters of the control device are filed in the memory.

[0049] Figure 3 shows a fitting of a sensor 8 into the valve block 4 or between the valve block 4 and the control device cover which, however, is not shown in Figure 3. By the exercising of a pressure by means of the control device cover 5 onto the sensor 8, the sensor 8 is pressed downward so that the seal 13 is reduced in its vertical dimension. By means of this pressure sensor, the pressure medium pressure in the pressure medium outlet bore 17 is measured by way of the sensor membrane. The measured values are then processed in the control device 20 which is arranged in the proximity and is not shown.

[0050] Figure 4 illustrates another possibility for fitting the pressure sensor 8 onto the pressure medium outlet bore 17. Here, the seals are arranged laterally of the pressure sensor, which preferably has a pot-shaped construction. This is therefore preferably a radial seal. The dimension and the movement of the sensor in the upward direction is limited by the control device cover 5.

Table of Reference Numbers

1	Pressure medium feeding connection
2	pressure medium return flow connection
3	outlet connection
4	housing bottom part (valve block)
5	control device cover
6	screw
7	solenoid vent
8	pressure sensor
9	printed circuit board opening
10	flexible line
11	mechanical control and regulating unit
12	solenoid valve
13	sealing element
14	microcontroller
15	instrument amplifier
16	electrically writable and readable or overwritable memory (such as EE or Flash ROM)
17	pressure medium outlet bore
18	control device cover seal
19	power semiconductor
20	control device
21	control device screw
22	connector
23	connector line
24	return valve

25 relief bore

26 relief space

27 printed circuit board

28 connector seal

29 measuring connection

30 pressure medium memory

31 control connection

32 cover screw

33 heat-conducting material

34 bending-resistant component

35 connector

36 signal line

39 flexible line

40 sensor membrane

Pressure Control Device for Vehicles

CLAIMS:

1. Pressure control device for vehicles comprising a control device (20), a mechanical, pneumatic and/or hydraulic element (4) and at least one sensor (8) and/or an actuator (12),
characterized in that, in the area of the sensors (8) and/or actuators (12), recesses or holes (9) are provided in the control device (20) and/or the element (4) in which the sensors (8) and/or actuators (12) can be accommodated at least partially.

2. Pressure control device according to Claim 1, characterized in that the control device (20) comprises a printed circuit board (27) which is provided with recesses or holes (9) for the sensors (8) and/or actuators (12).

3. Pressure control device according to Claim 1 and/or 2,
characterized in that the control device comprises a casing with a first and a second casing part (4, 5), the two casing parts (4, 5) being mutually connectible, and the first casing part (5) together with the second casing part (4) forming an

essentially closed chamber for at least the control device (20).

4. Pressure control device according to Claim 3, characterized in that the mechanical, pneumatic and/or hydraulic element is the second casing part.

5. Pressure control device according to one or several of Claims 1 to 4,
characterized in that the hydraulic element (4) is a valve block.

6. Pressure control device according to one or several of Claims 1 to 4,
characterized in that the second casing part (4) is a control valve block for the compressed-air system of a vehicle.

7. Pressure control device according to one or several of Claims 1 to 6,
characterized in that a bending-resistant element (34) is provided.

8. Pressure control device according to Claim 7, characterized in that the bending-resistant element (34) is a casing part (4, 5).

9. Pressure control device according to Claim 7, characterized in that the bending-resistant element (34) can be connected with a casing part (4, 5).

10. Pressure control device according to one or several of Claims 7 to 9,
characterized in that the bending resistance element (34) is provided for absorbing the pressure forces of the sensors (8) and/or actuators (12).

11. Pressure control device according to one or several of Claims 1 to 10,
characterized in that the controlling and the signal processing of the sensors (8) and/or actuators (12) takes place in the control device (20).

12. Pressure control device according to one or several of Claims 1 to 11,
characterized in that amplifiers (15, 19) are provided in the control device (20) which amplify the signals of the sensors (8).

13. Pressure control device according to Claim 12, characterized in that the amplifiers (15, 19) are arranged in the direct or indirect vicinity of the sensors (8) which can be assigned.

14. Pressure control device according to one or several of Claims 1 to 13,
characterized in that the electric connection (10) between the sensor (8) and the control device (20) takes place at least partially by way of flexible lines (10).

15. Pressure control device according to one or several of Claims 1 to 14,
characterized in that a storage element (16) is provided in the pressure control device.

16. Pressure control device according to Claim 15, characterized in that the calibrating values of the sensors (8) and/or actuators (12) and/or regulating parameters or control parameters of the control device (20) can be stored in the storage element (16).

17. Pressure control device according to one or several of Claims 3 to 16,
characterized in that the sensors (8) and/or actuators (12) are arranged in an area between the two casing parts (4, 5).

18. Pressure control device according to Claim 17, characterized in that the sensors (8) and/or actuators (12) are held by the two casing parts (4, 5).

19. Pressure control device according to one or several of Claims 1 to 18,
characterized in that at least one seal (13) is provided which seals off the sensors (8) and/or actuators (12).

20. Pressure control device according to Claim 19, characterized in that the seal is provided between the pressure connection of the second casing part (4) and the sensor (8).

21. Pressure control device according to one or several of Claims 1 to 20,
characterized in that the sensor (8) has a pot-shaped construction.

22. Pressure control device according to Claim 21, characterized in that the sensor (8) is held or guided by way of the edge of the pot bottom by a casing part.

23. Pressure control device according to Claim 21 and/or 22,
characterized in that the sensor membrane (40) is constructed on the pot bottom.

Marked-Up Substitute Specification

PRESSURE CONTROL DEVICE FOR VEHICLES

[Specification]

BACKGROUND AND SUMMARY OF THE INVENTION

The invention relates to a pressure control device for vehicles comprising a control device, a mechanical, pneumatic and/or hydraulic element and at least one sensor and/or an actuator.

Such pressure control devices are provided for use in pressure medium systems of, among others, vehicles. These may be constructed as pneumatic or hydraulic systems, in which case brake systems, level control systems, etc. are supplied by means of these systems.

German [Patent Document] patent document DE-A-44 45 125 discloses a housing for an electric component, which housing consists of a housing bottom part and a housing top part. These parts [which] can be connected with one another. In addition, a support is known from this document which supports the electric component situated in the housing and has corresponding electric connecting devices for the sealed connection of the electric component situated in the housing with an electric component situated outside the housing. Although such an arrangement has advantages in a modular

construction, it is very time-consuming to assemble it with additional components, such as sensors and actuators. Also, additional, relatively long cables for connecting the sensors and actuators with the control device as well as additional housings for the sensors and actuators are required for [a] protection against environmental influences. In addition, high-expenditure wirings and measures have to be carried out in order to protect the known control device against line-borne interferences of the additional cables.

It is therefore an object of the present invention to [indicate] provide a pressure control unit with a control device, a mechanical, pneumatic and/or hydraulic element and at least one sensor and/or an actuator. The [which provides a] connection of the control device with the sensors, actuators and additional elements [which require] requires only [little] a small amount of material, [permit a] permits fast assembly and therefore [save] saves time and cost.

This object is achieved in that a known pressure control device is further developed so that, in the area of the sensors and/or actuators, recesses or holes are provided in the control device and/or the mechanical, pneumatic and/or hydraulic element, in which the sensors and/or actuators can be at least partially accommodated.

The reason is that, as a result of this measure according to the invention, the mechanical, pneumatic and/or hydraulic element is moved into the direct proximity of the control device, so that the cable lengths can be kept short. Because of the measure that the mechanical, pneumatic and/or hydraulic element comprises a pressure control device, the assembly time is also reduced because now only one component or the pressure control device has [be] to be mounted on the vehicle essentially by itself and not, as previously, at least two components with an additional mounting of other cables. As a result, material costs are also saved because only few casing parts are required for protecting the respective components from environmental influences.

When, preferably, at least one sensor and/or an actuator is arranged in the casing, it is possible to calibrate and test the control device with the sensors and/or actuators as a simple structural component. When, preferably in the area of the sensors and/or actuators, recesses or holes are provided in the mechanical and/or pneumatic and/or hydraulic element and/or in the control device, the sensors and/or actuators can be moved into the direct proximity of the components of the control device, so that long cable lengths can be avoided. The holes or recesses are preferably constructed on mutually facing sides of the element and of the control device.

The control device used according to the invention is an electric and/or mechanical control device. The control device preferably comprises a printed circuit board which is provided with recesses or holes for the sensors and/or actuators. In this manner, an even more compact construction can be obtained which can be mounted more rapidly.

Also preferably, the pressure control device comprises a casing having a first and a second casing part, the casing parts being mutually connectible. The [and the] first casing part together with the second casing part for at least the control device [forming] forms an essentially closed chamber. This measure permits a simple mounting and, in addition, a simple protection against environmental influences for the control device and additional components, such as [particularly] in particular electric components.

The connectibility of the first and second casing part is preferably detachable in a firm manner. According to the field of application, seals are provided which protect the casing interior against water, [or] dirt or the like. Furthermore, connections of a mechanical or electrical nature are preferably provided which have the effect that the interior area of the casing can be connected with the exterior area.

The mechanical, pneumatic and/or hydraulic element is preferably the second casing part. Further material can be saved as a result of this measure.

The hydraulic element is preferably a valve block. In this manner, it is possible to use a valve block with the pertaining control device as a single structural component.

The second casing part is preferably a control valve block for the compressed-air system of a vehicle.

When a bending-resistant element is preferably provided, forces, which otherwise act upon the casing, can be compensated without damage to the casing or the control device.

The bending-resistant element is preferably a casing part. In addition, the bending-resistant element can preferably be connected with a casing part.

If the bending-resistant element is provided for absorbing the pressure forces of the sensors and/or actuators, the control device will be mechanically protected. If, for example, preferably the control device comprises a printed circuit board, as a result of the absorption of forces by the bending-resistant element, there will be no hairline cracks on

the printed circuit board because the latter will not be bent as a result of the application of force to the bending-resistant element.

Preferably, the controlling and the signal processing of the sensors and/or actuators takes place in the control device.

At least one amplifier is preferably provided in the control device, which amplifier amplifies the signals of the sensors. An active and/or passive cooling of the amplifiers (or of corresponding power semiconductors) is preferably provided. This cooling preferably takes place by way of cooling sheets and a portion of the exterior part of the casing.

If [preferably] the amplifiers are arranged preferably in the direct or indirect vicinity of the sensors, which can be assigned, the connections to the amplifiers can be kept short so that few outside interferences can enter these cables. If the electric connection between the sensor and the control device takes place at least partially by way of flexible lines or one flexible line, the sensors and actuators can be moved with respect to the control device while the connection to the control device would suffer no fatigue and would not be destroyed.

A storage element is preferably constructed in the pressure control device. Also preferably, the calibrating values of the sensors and/or actuators and/or regulating parameters or control parameters of the control device can be stored in the storage element. This measure has the advantage that no external storage elements are required so that additional longer cables are also avoided.

The sensors and/or actuators are preferably arranged in an area between the two casing parts. Also preferably, the sensors and/or actuators are held by the two casing parts. As a result of these measures, additional holding elements can preferably be saved and a mounting is correspondingly simplified.

If, preferably, at least one seal is provided which seals off the sensors and/or actuators, a discharge of pressure medium from the pressure medium outlet bore, for example, of a valve block, will be avoided. Depending on the embodiment of the present invention, different seals can be used which achieve the sealing in different fashions. The seal is preferably provided between the pressure connection of the second casing part and the sensor. As a result of this measure, only a single seal will be required. In addition, as a result of this measure, by means of the correspondingly firm or loose mounting of a component pressing onto the sensor,

such as the first casing part or the bending-resistant element, the contact pressure onto the seal can be adapted according to the requirements or pressure conditions, the used material, the environmental influences and the like.

The sensor is preferably cup-shaped. Also preferably, the sensor is held or guided by way of the edge of the cup-bottom by a casing part. As a result of this measure, the cup-shaped sensors can be fitted well. In the event of corresponding pressure variations, these will not cause corresponding pressure medium leakages at this connection from the pressure medium to the control device.

When the sensor membrane is preferably constructed on the cup bottom, this membrane is protected from corresponding damage by a not quite appropriate mounting.

The invention will be described in the following as an example without any limitation of the general idea of the invention by means of embodiments with reference to the drawings, to which reference is also made with respect to the disclosure of all details according to the invention which are not explained in detail in the text.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic representation of an embodiment of a casing according to the invention;

Figure 2 is a schematic representation of another embodiment of a casing according to the invention;

Figure 3 is a schematic and enlarged representation [of a] illustrating the fitting of a sensor onto a valve block; and

Figure 4 is a schematic representation of another fitting of a sensor onto a valve block.

DETAILED DESCRIPTION OF THE DRAWINGS

In the following figures, respective identical or corresponding parts have the same reference number so that they will not be introduced again and only deviations of the embodiments illustrated in these figures from the first embodiment will be discussed.

Figure 1 is a schematic representation of a first embodiment of the pressure control device according to the invention. Within the scope of this invention, the term pressure control device also comprises a pressure regulating device. Figure 1 specifically shows a control device cover 5 which is connected with a housing bottom part 4 by way of

screws 6. The pressure control device comprises the housing formed by the housing bottom part 4 and the control device cover 5. The control device 20 is arranged in this housing. The housing bottom part 4 is a valve block. The valve block has a pressure medium feeding connection [2] 1, a pressure medium return flow connection 2 and outlet connections 3. The outlet connections 3 are respectively connected with [a] pressure medium outlet [bore] bores 17. Furthermore, a mechanical control and regulating unit 11 is provided in the valve block and is connected with solenoid valves 12. In addition, recesses are provided in the valve block into which the control device screw heads 21 and pressure sensors 8 can be fitted[, and pressure sensors 8]. The mechanical control and regulating unit is also connected with a bore which leads to a return valve 24 which is connected with a relief bore 25 of the pressure sensors 8.

The control device 20 is fastened by means of control device screws 21 on the control device cover 5.

The components of the control device 20 are arranged on a printed circuit board [27] 21. Holes are provided in the printed circuit board 27 for accommodating the control device screws 27, the sensors 8 and the solenoids 12 in each case at least partially. Above the bores for the sensors, recesses are provided in the control device cover 5, which recesses

represent a relief space 26. The holes in the printed circuit board can also be called printed circuit board openings 9 which have a diameter D for the sensors. The signals from and to the sensors 8 are transmitted by way of flexible lines 10 to the printed circuit board or to components of the control device, which, in particular, are arranged on the printed circuit board. The components are, for example, microcontrollers 14, instrument amplifiers 15, electrically writable and readable or overwritable memories (such as EE or Flash ROM) 16 or power semiconductors 19.

In addition, solenoid valve vents 7 are provided in the control device cover 5. Sealing elements 13 are [proved] provided for sealing off, for example, the compressed air. For [the communication] communicating with the exterior area, particularly for transmitting electric or electronic signals from and to the control device, connectors 22 are provided which have a connector line 23.

In order to protect the control device from environmental influences, such as dirt, [and] water and the like, sealing elements are provided, such as a control device cover seal and a connector seal 28.

Figure 1 shows an embodiment as a multichannel pressure control valve. The implemented example of the invention

consists of a valve block 4, which has a pressure medium feeding connection 1, a pressure medium outlet connection 3 and a central pressure medium return flow connection 2 which, in the case of a pneumatic valve, is equal to a vent. The mechanical control and regulating unit 11 takes over the signal amplification functions and determines the backup regulating behavior of the valve in the event of a power failure.

The relief bore 25 of the relative pressure sensors 8 used in this example is connected with the return valve 24. As a result, it is possible to reduce pressure rises caused by temperature fluctuations in the relief space 26 to the central pressure medium return flow. In this manner, the pressure buildup in the relief space [because of] 26 due to sealing leakages can also [to] be reduced. The return valve 24 prevents the [penetrating] penetration of pressure surges from the pressure medium return flow 2 into the relief space 26.

The electric connections, thus particularly the voltage supply and the output signal of the pressure sensors 8, are fed by means of a flexible line 10 to the electric or electronic control device 20. The output signal of the pressure sensors is amplified by the instrument amplifier 15, before it is processed by the processor.

When the operation of the control device is first started, two defined pressures are applied to the pressure sensors, and the measured pertaining output signal values, which were processed by the control device, are stored in an electrically writable and erasable or electrically overwritable memory. It is therefore possible to use low-cost, not adjusted relative pressure sensors and to calibrate these.

The heat of the power semiconductors is transmitted by way of an applied heat-conducting material 33 into the control device cover in order to prevent overheating.

The solenoid valves 12 are also mounted on the control device, and their electric connections are also guided to the control device by means of a flexible line.

By means of the electric line 23, the connector 22 is connected with the control device 20. By means of the sealing element [27] 28, the connector 22 is sealed off with respect to the housing cover 5. The housing cover 5 is sealed off by means of the seal 18 with respect to the valve block 4. The housing cover 5 is screwed by means of the cover screws 6 onto the valve block. The valve block 4 represents the casing bottom part. As a result of this method of construction, a very compact design of a casing can be obtained which is easy

to mount and in which a control device as well as a mechanical, pneumatic and/or hydraulic element, such as a valve block or a cylinder block, are integrated. In addition, flexible lines 39 are provided.

In Figure 1, the housing cover 5 is constructed to be so bending-resistant that it absorbs and transmits forces affecting it while it is not significantly deformed or even damaged. The pressure forces acting upon the pressure sensors [and] are therefore returned into the valve block. The reason is that the pressure sensors are held down by the housing cover 5.

The embodiment according to the invention illustrated in Figure 2 shows an additional compressed-air storage device and a measuring connection for external pressures. External pressures can be measured by way of the measuring connection 29. This is required in the case of load sensing valve functioning methods. In addition, as illustrated above, an additional pressure medium storage device 30 exists so that the valve can rapidly react to high pressure demands in that pressure media are taken from this storage device. Another advantage of this construction is the possibility of absorbing external control pressures by the control connection 31.

Particularly in the case of narrow space conditions or narrow installation conditions, it is advantageous for the connector 22 to be arranged in the housing bottom part.

In addition, a bending-resistant component 34 is provided, which is not identical with the housing cover 5. As a result of this measure, particularly in the case of a large cover, the cover can be constructed at reasonable cost of a plastic material while the respective effective forces could not damage the cover. The bending-resistant component 34 can be constructed to be locally limited and small and can be connected particularly with the housing bottom part, thus, in this example, with the valve block. In this embodiment, the housing cover is screwed onto the housing bottom part by means of additional cover screws 32.

In addition, another connector 35 is shown which permits the receiving and processing or transmitting of external signals. The electric signals are fed to the control device by way of the signal line 36.

Thus, particularly also a control casing construction was introduced in which the following characteristics were in each case met individually, or partially or completely combined with one another. The casing bottom part is a valve block. The valve block has a pressure medium feeding connection and

at least one pressure medium outlet connection. The pressure in the pressure medium outlet bore is measured by a pressure sensor. A microcontroller compares the pressure in the pressure medium outlet bore with stored pressure values and correspondingly readjusts by means of an electrically controlled actuator. A mechanical control and regulating unit exists which determines the pressure, control and emergency operating characteristics in the event of a power failure. A pressure medium return flow connection is provided which, in the case of a pneumatic application corresponds to a venting. In addition, an electric control device is provided which has at least a power semiconductor 19, a microcontroller 14 and a writable data memory 16. In the area of the sensors, the printed circuit board of the electric control device is provided with an opening through which the sensors are guided and/or kept down. The pressure forces acting upon the sensors are compensated by a bending-resistant component which is connected with the valve block. The sensor signal is amplified by amplifiers situated on the printed circuit board. The electric supply of the sensor and the electric output signal of the sensor are transmitted to the printed circuit board by means of a flexible line. The calibrating values of the sensors and the regulating parameters of the control device are filed in the memory.

Figure 3 shows a fitting of a sensor 8 into the valve block 4 or between the valve block 4 and the control device cover which, however, is not shown in Figure 3. By the exercising of a pressure by means of the control device cover 5 onto the sensor 8, the sensor 8 is pressed downward so that the seal 13 is reduced in its vertical dimension. By means of this pressure sensor, the pressure medium pressure in the pressure medium outlet bore 17 is measured by way of the sensor membrane. The measured values are then processed in the control device 20 which is arranged in the proximity and is not shown.

Figure 4 illustrates another possibility for fitting the pressure sensor 8 onto the pressure medium outlet bore 17. Here, the seals are arranged laterally of the pressure sensor, which preferably has a pot-shaped construction. This is therefore preferably a radial seal. The dimension and the movement of the sensor in the upward direction is limited by the control device cover 5.

[List of Reference Numbers]

Table of Reference Numbers

1	Pressure medium feeding connection
2	pressure medium return flow connection
3	outlet connection
4	housing bottom part (valve block)
5	control device cover
6	screw
7	solenoid vent
8	pressure sensor
9	printed circuit board opening
10	flexible line
11	mechanical control and regulating unit
12	solenoid valve
13	sealing element
14	microcontroller
15	instrument amplifier
16	electrically writable and readable or overwritable memory (such as EE or Flash ROM)
17	pressure medium outlet bore
18	control device cover seal
19	power semiconductor
20	control device
21	control device screw
22	connector

23 connector line

24 return valve

25 relief bore

26 relief space

27 printed circuit board

28 connector seal

29 measuring connection

30 pressure medium memory

31 control connection

32 cover screw

33 heat-conducting material

34 bending-resistant component

35 connector

36 signal line

[37]

39 flexible line

40 sensor membrane

Pressure Control Device for Vehicles

CLAIMS:

1. Pressure control device for vehicles comprising a control device (20), a mechanical, pneumatic and/or hydraulic element (4) and at least one sensor (8) and/or an actuator (12),
characterized in that, in the area of the sensors (8) and/or actuators (12), recesses or holes (9) are provided in the control device (20) and/or the element (4) in which the sensors (8) and/or actuators (12) can be accommodated at least partially.

2. Pressure control device according to Claim 1, characterized in that the control device (20) comprises a printed circuit board (27) which is provided with recesses or holes (9) for the sensors (8) and/or actuators (12).

3. Pressure control device according to Claim 1 and/or 2,
characterized in that the control device comprises a casing with a first and a second casing part (4, 5), the two casing parts (4, 5) being mutually connectible, and the first casing part (5) together with the second casing part (4) forming an

essentially closed chamber for at least the control device (20).

4. Pressure control device according to Claim 3, characterized in that the mechanical, pneumatic and/or hydraulic element is the second casing part.

5. Pressure control device according to one or several of Claims 1 to 4,
characterized in that the hydraulic element (4) is a valve block.

6. Pressure control device according to one or several of Claims 1 to 4,
characterized in that the second casing part (4) is a control valve block for the compressed-air system of a vehicle.

7. Pressure control device according to one or several of Claims 1 to 6,
characterized in that a bending-resistant element (34) is provided.

8. Pressure control device according to Claim 7, characterized in that the bending-resistant element (34) is a casing part (4, 5).

9. Pressure control device according to Claim 7, characterized in that the bending-resistant element (34) can be connected with a casing part (4, 5).

10. Pressure control device according to one or several of Claims 7 to 9,
characterized in that the bending resistance element (34) is provided for absorbing the pressure forces of the sensors (8) and/or actuators (12).

11. Pressure control device according to one or several of Claims 1 to 10,
characterized in that the controlling and the signal processing of the sensors (8) and/or actuators (12) takes place in the control device (20).

12. Pressure control device according to one or several of Claims 1 to 11,
characterized in that amplifiers (15, 19) are provided in the control device (20) which amplify the signals of the sensors (8).

13. Pressure control device according to Claim 12, characterized in that the amplifiers (15, 19) are arranged in the direct or indirect vicinity of the sensors (8) which can be assigned.

14. Pressure control device according to one or several of Claims 1 to 13,
characterized in that the electric connection (10) between the sensor (8) and the control device (20) takes place at least partially by way of flexible lines (10).

15. Pressure control device according to one or several of Claims 1 to 14,
characterized in that a storage element (16) is provided in the pressure control device.

16. Pressure control device according to Claim 15, characterized in that the calibrating values of the sensors (8) and/or actuators (12) and/or regulating parameters or control parameters of the control device (20) can be stored in the storage element (16).

17. Pressure control device according to one or several of Claims 3 to 16,
characterized in that the sensors (8) and/or actuators (12) are arranged in an area between the two casing parts (4, 5).

18. Pressure control device according to Claim 17, characterized in that the sensors (8) and/or actuators (12) are held by the two casing parts (4, 5).

19. Pressure control device according to one or several of Claims 1 to 18,
characterized in that at least one seal (13) is provided which seals off the sensors (8) and/or actuators (12).

20. Pressure control device according to Claim 19, characterized in that the seal is provided between the pressure connection of the second casing part (4) and the sensor (8).

21. Pressure control device according to one or several of Claims 1 to 20,
characterized in that the sensor (8) has a pot-shaped construction.

22. Pressure control device according to Claim 21, characterized in that the sensor (8) is held or guided by way of the edge of the pot bottom by a casing part.

23. Pressure control device according to Claim 21 and/or 22,
characterized in that the sensor membrane (40) is constructed on the pot bottom.

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Applicant: EDUARD HILBERER

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PRESSURE CONTROL DEVICE FOR VEHICLES

Specification

The invention relates to a pressure control device for vehicles comprising a control device, a mechanical, pneumatic and/or hydraulic element and at least one sensor and/or an actuator.

Such pressure control devices are provided for use in pressure medium systems of, among others, vehicles. These may be constructed as pneumatic or hydraulic systems, in which case brake systems, level control systems, etc. are supplied by means of these systems.

German Patent Document DE-A-44 45 125 discloses a housing for an electric component, which housing consists of a housing bottom part and a housing top part which can be connected with one another. In addition, a support is known from this document which supports the electric component situated in the housing and has corresponding electric connecting devices for the sealed connection of the electric component situated in the housing with

an electric component situated outside the housing. Although such an arrangement has advantages in a modular construction, it is very time-consuming to assemble it with additional components, such as sensors and actuators. Also, additional, relatively long cables for connecting the sensors and actuators with the control device as well as additional housings for the sensors and actuators are required for a protection against environmental influences. In addition, high-expenditure wirings and measures have to be carried out in order to protect the known control device against line-borne interferences of the additional cables.

It is therefore an object of the present invention to indicate a pressure control unit with a control device, a mechanical, pneumatic and/or hydraulic element and at least one sensor and/or an actuator which provides a connection of the control device with sensors, actuators and additional elements which require only little material, permit a fast assembly and therefore save time and cost.

This object is achieved in that a known pressure control device is further developed so that, in the area of the sensors and/or actuators, recesses or holes are provided in the control device and/or the mechanical, pneumatic and/or hydraulic element, in which the sensors and/or actuators can be at least partially

accommodated.

The reason is that, as a result of this measure according to the invention, the mechanical, pneumatic and/or hydraulic element is moved into the direct proximity of the control device, so that the cable lengths can be kept short. Because of the measure that the mechanical, pneumatic and/or hydraulic element comprises a pressure control device, the assembly time is also reduced because now only one component or the pressure control device has be to mounted on the vehicle essentially by itself and not, as previously, at least two components with an additional mounting of other cables. As a result, material costs are also saved because only few casing parts are required for protecting the respective components from environmental influences.

When preferably at least one sensor and/or an actuator is arranged in the casing, it is possible to calibrate and test the control device with the sensors and/or actuators as a simple structural component. When, preferably in the area of the sensors and/or actuators, recesses or holes are provided in the mechanical and/or pneumatic and/or hydraulic element and/or in the control device, the sensors and/or actuators can be moved into the direct proximity of the components of the control device, so that long cable lengths can be avoided. The holes or

recesses are preferably constructed on mutually facing sides of the element and of the control device.

The control device used according to the invention is an electric and/or mechanical control device. The control device preferably comprises a printed circuit board which is provided with recesses or holes for the sensors and/or actuators. In this manner, an even more compact construction can be obtained which can be mounted more rapidly.

Also preferably, the pressure control device comprises a casing having a first and a second casing part, the casing parts being mutually connectible and the first casing part together with the second casing part for at least the control device forming an essentially closed chamber. This measure permits a simple mounting and, in addition, a simple protection against environmental influences for the control device and additional components, such as particularly electric components.

The connectibility of the first and second casing part is preferably detachable in a firm manner. According to the field of application, seals are provided which protect the casing interior against water or dirt or the like. Furthermore, connections of a mechanical or electrical nature are preferably

provided which have the effect that the interior area of the casing can be connected with the exterior area.

The mechanical, pneumatic and/or hydraulic element is preferably the second casing part. Further material can be saved as a result of this measure.

The hydraulic element is preferably a valve block. In this manner, it is possible to use a valve block with the pertaining control device as a single structural component.

The second casing part is preferably a control valve block for the compressed-air system of a vehicle.

When a bending-resistant element is preferably provided, forces, which otherwise act upon the casing, can be compensated without damage to the casing or the control device.

The bending-resistant element is preferably a casing part. In addition, the bending-resistant element can preferably be connected with a casing part.

If the bending-resistant element is provided for absorbing the pressure forces of the sensors and/or actuators, the control

device will be mechanically protected. If, for example, preferably the control device comprises a printed circuit board, as a result of the absorption of forces by the bending-resistant element, there will be no hairline cracks on the printed circuit board because the latter will not be bent as a result of the application of force to the bending-resistant element.

Preferably, the controlling and the signal processing of the sensors and/or actuators takes place in the control device.

At least one amplifier is preferably provided in the control device, which amplifier amplifies the signals of the sensors. An active and/or passive cooling of the amplifiers or of corresponding power semiconductors is preferably provided. This cooling preferably takes place by way of cooling sheets and a portion of the exterior part of the casing.

If preferably the amplifiers are arranged in the direct or indirect vicinity of the sensors, which can be assigned, the connections to the amplifiers can be kept short so that few outside interferences can enter these cables. If the electric connection between the sensor and the control device takes place at least partially by way of flexible lines or one flexible line, the sensors and actuators can be moved with respect to the

control device while the connection to the control device would suffer no fatigue and would not be destroyed.

A storage element is preferably constructed in the pressure control device. Also preferably, the calibrating values of the sensors and/or actuators and/or regulating parameters or control parameters of the control device can be stored in the storage element. This measure has the advantage that no external storage elements are required so that additional longer cables are also avoided.

The sensors and/or actuators are preferably arranged in an area between the two casing parts. Also preferably, the sensors and/or actuators are held by the two casing parts. As a result of these measures, additional holding elements can preferably be saved and a mounting is correspondingly simplified.

If, preferably, at least one seal is provided which seals off the sensors and/or actuators, a discharge of pressure medium from the pressure medium outlet bore, for example, of a valve block, will be avoided. Depending on the embodiment of the present invention, different seals can be used which achieve the sealing in different fashions. The seal is preferably provided between the pressure connection of the second casing part and the

sensor. As a result of this measure, only a single seal will be required. In addition, as a result of this measure, by means of the correspondingly firm or loose mounting of a component pressing onto the sensor, such as the first casing part or the bending-resistant element, the contact pressure onto the seal can be adapted according to the requirements or pressure conditions, the used material, the environmental influences and the like.

The sensor is preferably cup-shaped. Also preferably, the sensor is held or guided by way of the edge of the cup-bottom by a casing part. As a result of this measure, the cup-shaped sensors can be fitted well. In the event of corresponding pressure variations, these will not cause corresponding pressure medium leakages at this connection from the pressure medium to the control device.

When the sensor membrane is preferably constructed on the cup bottom, this membrane is protected from corresponding damage by a not quite appropriate mounting.

The invention will be described in the following as an example without any limitation of the general idea of the invention by means of embodiments with reference to the drawings, to which reference is also made with respect to the disclosure of

all details according to the invention which are not explained in detail in the text.

Figure 1 is a schematic representation of an embodiment of a casing according to the invention;

Figure 2 is a schematic representation of another embodiment of a casing according to the invention;

Figure 3 is a schematic and enlarged representation of a fitting of a sensor onto a valve block; and

Figure 4 is a schematic representation of another fitting of a sensor onto a valve block.

In the following figures, respective identical or corresponding parts have the same reference number so that they will not be introduced again and only deviations of the embodiments illustrated in these figures from the first embodiment will be discussed.

Figure 1 is a schematic representation of a first embodiment of the pressure control device according to the invention. Within the scope of this invention, the term pressure control

device also comprises a pressure regulating device. Figure 1 specifically shows a control device cover 5 which is connected with a housing bottom part 4 by way of screws 6. The pressure control device comprises the housing formed by the housing bottom part and the control device cover. The control device 20 is arranged in this housing. The housing bottom part 4 is a valve block. The valve block has a pressure medium feeding connection 2, a pressure medium return flow connection 2 and outlet connections 3. The outlet connections 3 are connected with a pressure medium outlet bore 17. Furthermore, a mechanical control and regulating unit 11 is provided in the valve block and is connected with solenoid valves 12. In addition, recesses are provided in the valve block into which the control device screw heads 21 can be fitted, and pressure sensors 8. The mechanical control and regulating unit is also connected with a bore which leads to a return valve 24 which is connected with a relief bore 25 of the pressure sensors 8.

The control device 20 is fastened by means of control device screws 21 on the control device cover 5.

The components of the control device 20 are arranged on a printed circuit board 27. Holes are provided in the printed circuit board 27 for accommodating the control device screws 27,

the sensors 8 and the solenoids 12 in each case at least partially. Above the bores for the sensors, recesses are provided in the control device cover 5, which recesses represent a relief space 26. The holes in the printed circuit board can also be called printed circuit board openings 9 which have a diameter D for the sensors. The signals from and to the sensors 8 are transmitted by way of flexible lines 10 to the printed circuit board or to components of the control device, which, in particular, are arranged on the printed circuit board. The components are, for example, microcontrollers 14, instrument amplifiers 15, electrically writable and readable or overwritable memories (such as EE or Flash ROM) 16 or power semiconductors 19.

In addition, solenoid valve vents 7 are provided in the control device cover 5. Sealing elements 13 are proved for sealing off, for example, the compressed air. For the communication with the exterior area, particularly for transmitting electric or electronic signals from and to the control device, connectors 22 are provided which have a connector line 23.

In order to protect the control device from environmental influences, such as dirt and water and the like, sealing elements are provided, such as a control device cover seal and a connector

seal 28.

Figure 1 shows an embodiment as a multichannel pressure control valve. The implemented example of the invention consists of a valve block 4 which has a pressure medium feeding connection 1, a pressure medium outlet connection 3 and a central pressure medium return flow connection 2 which, in the case of a pneumatic valve, is equal to a vent. The mechanical control and regulating unit 11 takes over the signal amplification functions and determines the backup regulating behavior of the valve in the event of a power failure.

The relief bore 25 of the relative pressure sensors 8 used in this example is connected with the return valve 24. As a result, it is possible to reduce pressure rises caused by temperature fluctuations in the relief space 26 to the central pressure medium return flow. In this manner, the pressure buildup in the relief space because of sealing leakages can also to be reduced. The return valve prevents the penetrating of pressure surges from the pressure medium return flow 2 into the relief space 26.

The electric connections, thus particularly the voltage supply and the output signal of the pressure sensors 8, are fed

by means of a flexible line 10 to the electric or electronic control device 20. The output signal of the pressure sensors is amplified by the instrument amplifier 15, before it is processed by the processor.

When the operation of the control device is first started, two defined pressures are applied to the pressure sensors, and the measured pertaining output signal values, which were processed by the control device, are stored in an electrically writable and erasable or electrically overwritable memory. It is therefore possible to use low-cost, not adjusted relative pressure sensors and to calibrate these.

The heat of the power semiconductors is transmitted by way of an applied heat-conducting material 33 into the control device cover in order to prevent overheating.

The solenoid valves 12 are also mounted on the control device, and their electric connections are also guided to the control device by means of a flexible line.

By means of the electric line 23, the connector 22 is connected with the control device 20. By means of the sealing element 27, the connector 22 is sealed off with respect to the

housing cover 5. The housing cover 5 is sealed off by means of the seal 18 with respect to the valve block 4. The housing cover 5 is screwed by means of the cover screws 6 onto the valve block. The valve block 4 represents the casing bottom part. As a result of this method of construction, a very compact design of a casing can be obtained which is easy to mount and in which a control device as well as a mechanical, pneumatic and/or hydraulic element, such as a valve block or a cylinder block, are integrated. In addition, flexible lines 39 are provided.

In Figure 1, the housing cover 5 is constructed to be so bending-resistant that it absorbs and transmits forces affecting it while it is not significantly deformed or even damaged. The pressure forces acting upon the pressure sensors and therefore returned into the valve block. The reason is that the pressure sensors are held down by the housing cover 5.

The embodiment according to the invention illustrated in Figure 2 shows an additional compressed-air storage device and a measuring connection for external pressures. External pressures can be measured by way of the measuring connection 29. This is required in the case of load sensing valve functioning methods. In addition, as illustrated above, an additional pressure medium storage device 30 exists so that the valve can rapidly react to

high pressure demands in that pressure media are taken from this storage device. Another advantage of this construction is the possibility of absorbing external control pressures by the control connection 31.

Particularly in the case of narrow space conditions or narrow installation conditions, it is advantageous for the connector 22 to be arranged in the housing bottom part.

In addition, a bending-resistant component 34 is provided which is not identical with the housing cover 5. As a result of this measure, particularly in the case of a large cover, the cover can be constructed at reasonable cost of a plastic material while the respective effective forces could not damage the cover. The bending-resistant component 34 can be constructed to be locally limited and small and can be connected particularly with the housing bottom part, thus, in this example, with the valve block. In this embodiment, the housing cover is screwed onto the housing bottom part by means of additional cover screws 32.

In addition, another connector 35 is shown which permits the receiving and processing or transmitting of external signals. The electric signals are fed to the control device by way of the signal line 36.

Thus, particularly also a control casing construction was introduced in which the following characteristics were in each case met individually, or partially or completely combined with one another. The casing bottom part is a valve block. The valve block has a pressure medium feeding connection and at least one pressure medium outlet connection. The pressure in the pressure medium outlet bore is measured by a pressure sensor. A microcontroller compares the pressure in the pressure medium outlet bore with stored pressure values and correspondingly readjusts by means of an electrically controlled actuator. A mechanical control and regulating unit exists which determines the pressure, control and emergency operating characteristics in the event of a power failure. A pressure medium return flow connection is provided which, in the case of a pneumatic application corresponds to a venting. In addition, an electric control device is provided which has at least a power semiconductor 19, a microcontroller 14 and a writable data memory 16. In the area of the sensors, the printed circuit board of the electric control device is provided with an opening through which the sensors are guided and/or kept down. The pressure forces acting upon the sensors are compensated by a bending-resistant component which is connected with the valve block. The sensor signal is amplified by amplifiers situated on the printed circuit board. The electric supply of the sensor and the electric output

signal of the sensor are transmitted to the printed circuit board by means of a flexible line. The calibrating values of the sensors and the regulating parameters of the control device are filed in the memory.

Figure 3 shows a fitting of a sensor 8 into the valve block 4 or between the valve block 4 and the control device cover which, however, is not shown in Figure 3. By the exercising of a pressure by means of the control device cover 5 onto the sensor 8, the sensor 8 is pressed downward so that the seal 13 is reduced in its vertical dimension. By means of this pressure sensor, the pressure medium pressure in the pressure medium outlet bore 17 is measured by way of the sensor membrane. The measured values are then processed in the control device 20 which is arranged in the proximity and is not shown.

Figure 4 illustrates another possibility for fitting the pressure sensor 8 onto the pressure medium outlet bore 17. Here, the seals are arranged laterally of the pressure sensor which preferably has a pot-shaped construction. This is therefore preferably a radial seal. The dimension and the movement of the sensor in the upward direction is limited by the control device cover 5.

List of Reference Numbers

1	Pressure medium feeding connection
2	pressure medium return flow connection
3	outlet connection
4	housing bottom part (valve block)
5	control device cover
6	screw
7	solenoid vent
8	pressure sensor
9	printed circuit board opening
10	flexible line
11	mechanical control and regulating unit
12	solenoid valve
13	sealing element
14	microcontroller
15	instrument amplifier
16	electrically writable and readable or overwritable memory (such as EE or Flash ROM)
17	pressure medium outlet bore
18	control device cover seal
19	power semiconductor
20	control device

21 control device screw

22 connector

23 connector line

24 return valve

25 relief bore

26 relief space

27 printed circuit board

28 connector seal

29 measuring connection

30 pressure medium memory

31 control connection

32 cover screw

33 heat-conducting material

34 bending-resistant component

35 connector

36 signal line

37

39 flexible line

40 sensor membrane

Pressure Control Device for Vehicles

(NEW) CLAIMS:

1. Pressure control device for vehicles comprising a control device (20), a mechanical, pneumatic and/or hydraulic element (4) and at least one sensor (8), in the area of the at least one sensor (8), recesses or holes (9) being provided in the control device (20) and/or the element (4) in which the at least one sensor (8) can be accommodated at least partially, characterized in that a bending resistance element (34) is provided for absorbing the pressure forces of the at least one sensor (8).

2. Pressure control device according to Claim 1, characterized in that the control device (20) comprises a printed circuit board (27) which is provided with recesses or holes (9) for the at least one sensor (8).

3. Pressure control device according to Claim 1 and/or 2,
characterized in that the control device comprises a casing with a first and a second casing part (4, 5), the two casing parts (4, 5) being mutually connectible, and the first casing part (5) together with the second casing part (4) forming an

essentially closed chamber for at least the control device (20).

4. Pressure control device according to Claim 3, characterized in that the mechanical, pneumatic and/or hydraulic element is the second casing part.

5. Pressure control device according to one or several of Claims 1 to 4,
characterized in that the hydraulic element (4) is a valve block.

6. Pressure control device according to one or several of Claims 1 to 4,
characterized in that the second casing part (4) is a control valve block for the compressed-air system of a vehicle.

7. Pressure control device according to one or several of Claims 1 to 6,
characterized in that the bending-resistant element (34) is a casing part (4, 5).

8. Pressure control device according to one or several of Claims 1 to 6,
characterized in that the bending-resistant element (34) can be connected with a casing part (4, 5).

9. Pressure control device according to one or several of Claims 1 to 8,
characterized in that the controlling and the signal processing of the at least one sensor (8) takes place in the control device (20).

10. Pressure control device according to one or several of Claims 1 to 9,
characterized in that amplifiers (15, 19) are provided in the control device (20) which amplify the signal or signals of the at least one sensor (8).

11. Pressure control device according to Claim 10,
characterized in that the amplifiers (15, 19) are arranged in the direct or indirect vicinity of the sensors (8) which can be assigned.

12. Pressure control device according to one or several of Claims 1 to 11,
characterized in that the electric connection (10) between the sensor (8) and the control device (20) takes place at least partially by way of flexible lines (10).

13. Pressure control device according to one or several of Claims 1 to 12,
characterized in that a storage element (16) is provided in

the pressure control device.

14. Pressure control device according to Claim 13, characterized in that the calibrating values of the at least one sensor (8) and/or regulating parameters or control parameters of the control device (20) can be stored in the storage element (16).

15. Pressure control device according to one or several of Claims 3 to 14,
characterized in that the at least one sensor (8) is arranged in an area between the two casing parts (4, 5).

16. Pressure control device according to Claim 15, characterized in that the at least one sensor (8) is held by the two casing parts (4, 5).

17. Pressure control device according to one or several of Claims 1 to 16,
characterized in that at least one seal (13) is provided which seals off the at least one sensor (8).

18. Pressure control device according to Claim 17, characterized in that the seal is provided between the pressure connection of the second casing part (4) and the at least one sensor (8).

19. Pressure control device according to one or several of Claims 1 to 18,

characterized in that the at least one sensor (8) has a pot-shaped construction.

20. Pressure control device according to Claim 19,

characterized in that the at least one sensor (8) is held or guided by way of the edge of the pot bottom by a casing part.

21. Pressure control device according to Claim 19 and/or 20,

characterized in that the sensor membrane (40) is constructed on the pot bottom.

Fig. 1

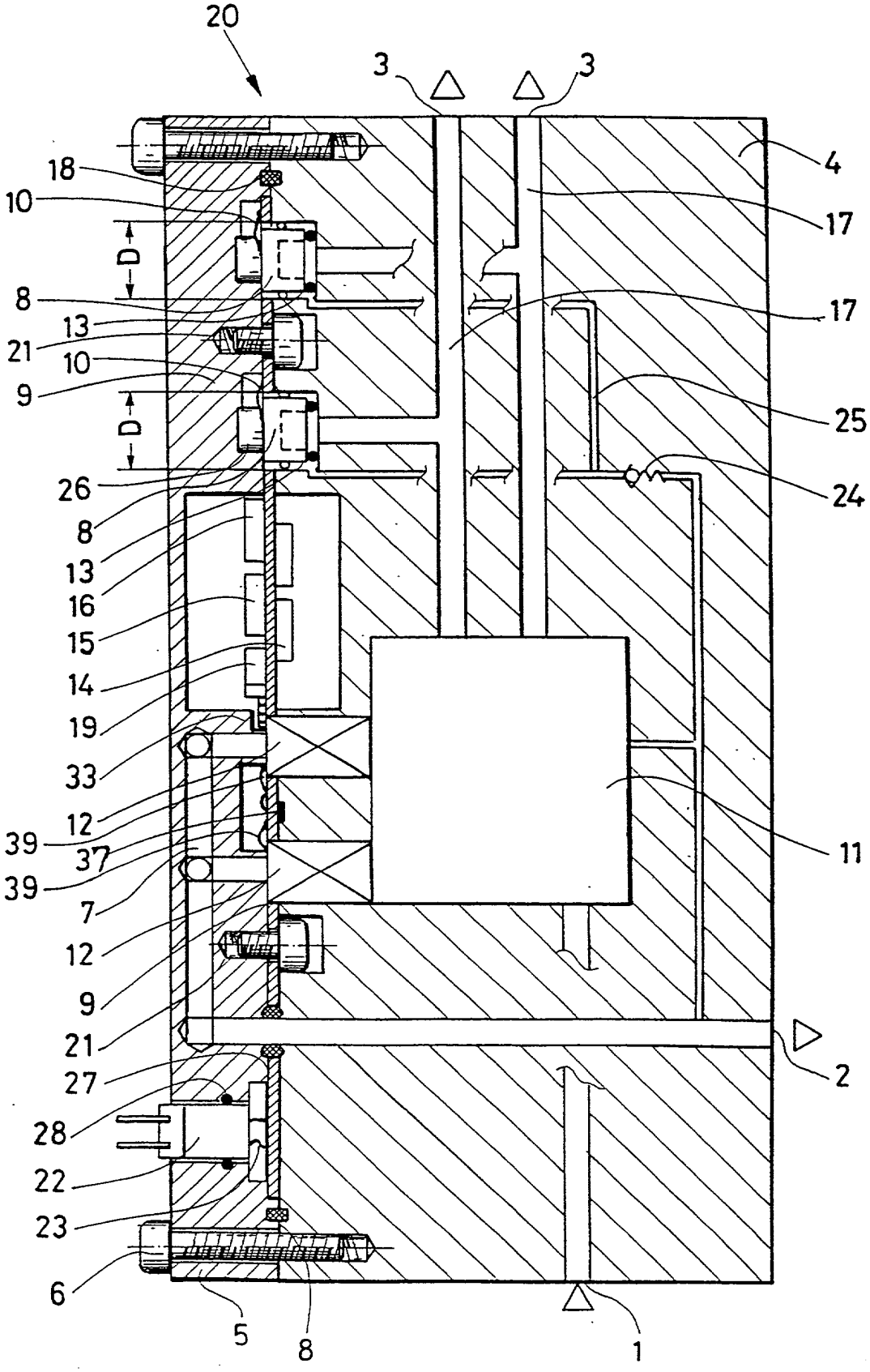


Fig. 2

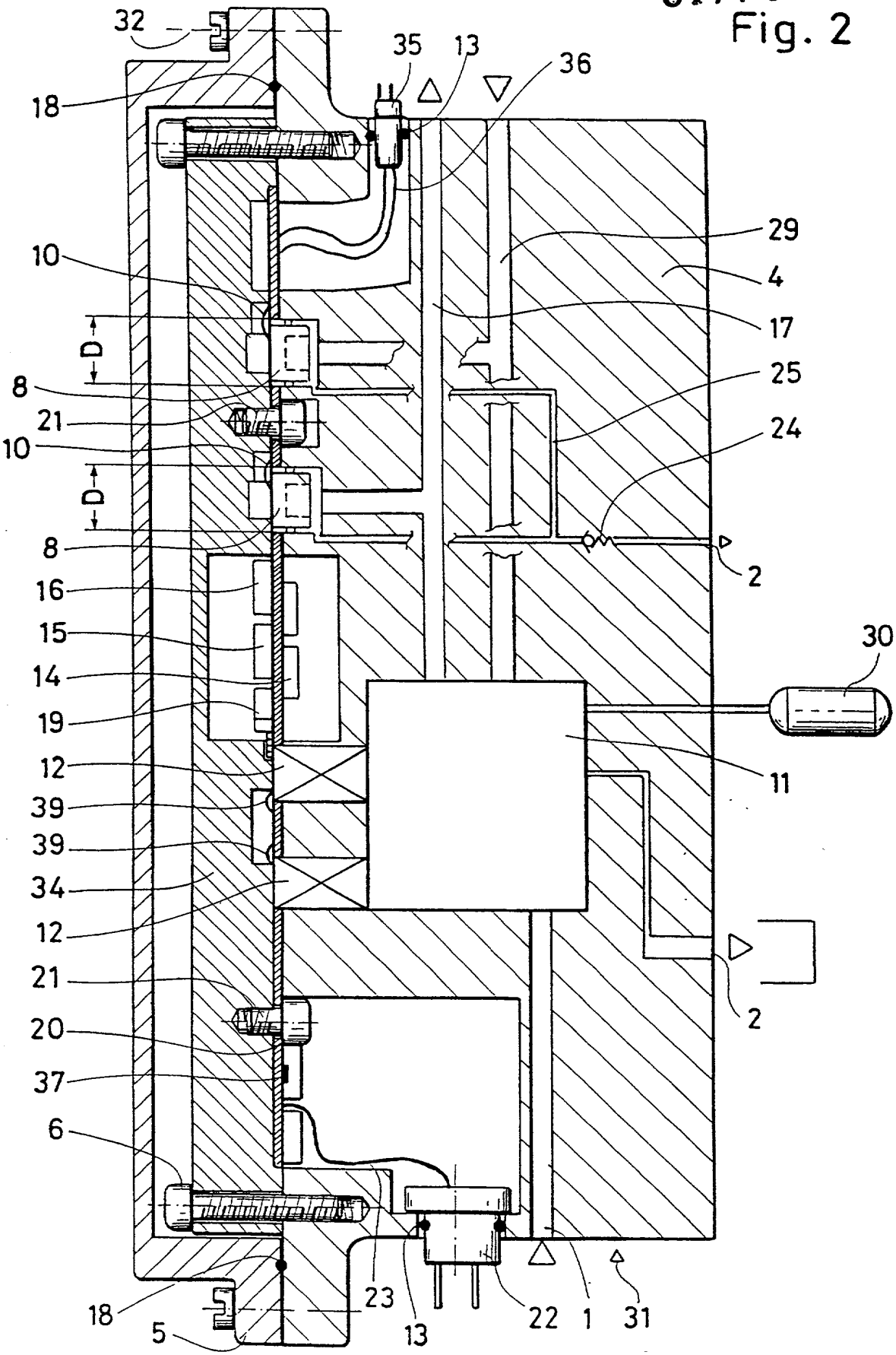


Fig. 3

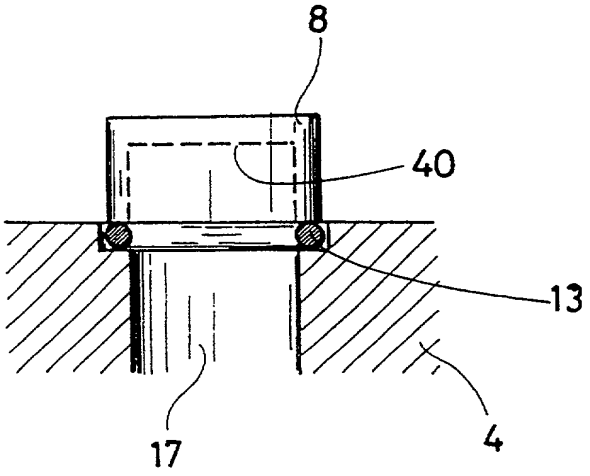
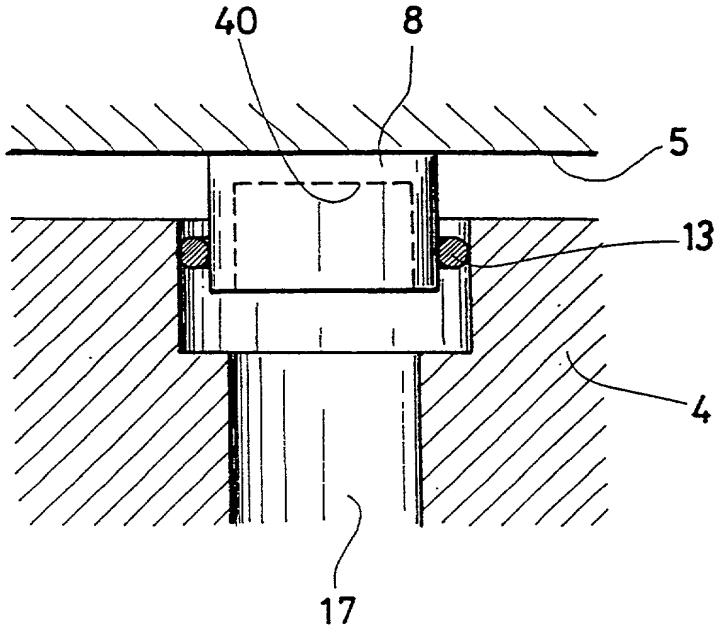


Fig. 4



COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY
(includes Reference to PCT International Applications)

ATTORNEY'S DOCKET NUMBER

1662/49745

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

PRESSURE CONTROL DEVICE FOR VEHICLES

the specification of which (check only one item below):

[ ] is attached hereto.

[ ] was filed as United States application
Serial No. _____
on _____
and was amended
on _____ (if applicable).

[X] was filed as PCT international application
Number **PCT/EP99/06401**
on **1 September 1999**
and was amended under PCT Article 19
on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations. §1.56(a).

I hereby claim foreign priority benefits under Title 35, United State Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT indicate PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
Germany	**198 39 843.3**	**2 September 1998**	[X] Yes [ ] No
			[ ] Yes [ ] No
			[ ] Yes [ ] No
			[ ] Yes [ ] No
			[ ] Yes [ ] No

Combined Declaration For Patent Application and Power of Attorney (Continued) (includes Reference to PCT international Applications	ATTORNEY'S DOCKET NUMBER 1662/49745

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national of PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120

U.S. APPLICATIONS		STATUS (Check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (IF ANY)			

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

(6)

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Send Correspondence to: Crowell & Moring, L.L.P. P.O. Box 14300 Washington, D.C. 20044-4300				Direct Telephone Calls to. *(name and telephone number)* (202) 628-8800
201	FULL NAME OF INVENTOR	FAMILY NAME **HILBERER**	FIRST GIVEN NAME **Eduard**	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY **Hockenheim**	STATE OR FOREIGN COUNTRY **Germany**	COUNTRY OF CITIZENSHIP **Germany** DEX
	POST OFFICE ADDRESS	POST OFFICE ADDRESS **Am Damm 5**	CITY **Hockenheim**	STATE & ZIP CODE/COUNTRY **D-68766, Germany**
202	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
203	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
E. Hilberer		
DATE 30/07/01	Date	DATE